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three have been obtained in a moribund state,—a single one only with sufficient life to enable Gundlach to describe and figure the animal. A few square yards contain all we know of this species. *Achatina fasciata* is found from one end of the island to the other, and at all elevations above the sea, under several forms which have been described as distinct species. *Helix picta* Born. is another widely diffused shell, and extremely variable in color and size. I have observed many young in the top branches of a high tree just felled, on the very top of the mountains, in Yateras. It seems to be a high climber, which may account for its comparative rarity, fully grown and alive. I have met with very few.

Cylindrella is largely represented in Cuba, more than eighty species being enumerated in the latest catalogue. Most of the species are extremely local; several, so far as is now known, being restricted to localities of a few yards square, or to a few rods. Doubless other localities will be discovered for many of them. A few, as *C. Poeyana*, *C. elegans* and *C. irrorata*, are much more widely spread, but probably not one extends through the whole island as does *Achatina fasciata*. But what is most noteworthy is the remarkable tenacity of life possessed by many species. Some have lived for months, and even years; and, unless closely confined, they will crawl forth on the return of warm, damp spells of weather, getting into the wrong boxes and creating sad confusion.

## THE SMALLER FUNGI.

BY JOHN L. RUSSELL.

[Concluded from page 570.]

ANOTHER point of interest worthy the attention of the observer, and furnishing subject matter for the microscope, is a sort of dimorphism,* and even something like alternate generations such as is observed in the lower animals. We have seen that the spermogones which accompany the cluster-cups in the *Æcidium*, for instance, seem to have some intimate relation to them. There is another kind of the smaller fungi which, attacking grain, is known as *Rust*, and in science is called *Uredo*. But besides the *U. rubigo*, or Rust, on the grasses and grain, Dr. Curtis enumerates twenty-eight other species which attack other plants, and which have come under his observation. In other sections of the United States other species are found, and on the cultivated roses of the gardens, an European species, the *Uredo rosæ*, has fallen under my notice. Of this particular kind of Rust, our author says, "in the Uredines as well as other of the Coniomycetes (in which the spores are the principal features), the same fungus appears under two or more distinct forms, not necessarily mere differences of age, but so distinct that they have been regarded (and some are so still) as different species belonging to different genera, often far removed from each other, and bearing different names. One plant (fungus), for instance, sprinkled over the under surface of a rose-leaf, like tumeric powder, has its mycelium, or root-like threads, penetrating the tissue, whilst bearing above its spherical golden colored spores. Its vegetative system is complete, and apparently its reproductive also; hence it seems to claim recognition as a perfect plant, and under the name of *Uredo rosæ* was so recognized, until microscopical investigation determined otherwise. Thus, it has been discovered that certain dark brown spots which appear later in the season, are produced upon the same mycelium, and are indeed, aggregations of more perfect and complex fruits of the same plant. Before this point was satisfactorily decided, the brown spores, which are borne on long stalks and are themselves septate, or divided by transverse partitions into a complex fruit, received the name of *Puccinia rosæ*. At this period *Uredo rosæ* and *Puccinia rosæ*, or the yellow fungus and the dark brown fungus, were believed to be distinct and different plants; now, on the contrary, they are believed to be different forms of fruit produced by the same plant, *i. e.*, an instance of dimorphism."

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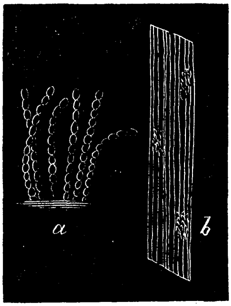
* *Dimorphism*, two shapes or forms.

Fig. 1.



A similar instance of this two-formed condition of the smaller fungi can be traced in the delicate mouldiness which covers the leaves of many plants, as the lilac, the grape, and the fruit of the gooseberry, and looks like strings of beads made of colorless cells, in this condition known or described as *Oidium* (Fig. 1; *a*, tuft of conidia of *O. monilioides* × 120; *b*, portion of grass-leaf with the same species of blight. From Cooke), the spores being the selfsame beads, and egg-shaped or oviform, whence the generic name; but careful observation will persuade us that this is not the perfect condition; and when later in autumn these threads become more compact, and are surmounted on their horizontal surfaces by shining black capsules, or perithecia, each of which is filled with elegant elliptical and elongated cells, and each in turn containing several spores, shall we find in *Erisyphe* that we have arrived at the conclusion of the dimorphism of this fungus, a parasite and injurious in its effects. The famous grape mildew, so destructive to the foliage of the wine and table grapes of Europe, and known as *Oidium Tuckeri*, is thus only an imperfect form of some common *Erisyphe*, or mildew; and in this portion of Massachusetts, so far as I have observed, it is the *Uncinula spiralis* (B. and C.) which attacked the foliage of the sweet water grapes, as on vines of Mr. E. S. Rogers of Salem, in 1850, and the same parasitic fungus which covered the leaves of the wild grape, Isabella, and other hardy varieties, and which can be detected every season to a greater or less extent.

And besides this dimorphism thus apparent in the smaller fungi, stranger facts connected with their natural history meet us here. Observation has detected in the Æcidium, or cluster-cups, not a perfect fungus as it would seem, but in them only a condition of some other fungus! Thus the genus *Uromyces* contains several distinct kinds of minute fungi, of which, for example, we will select the bean-leaf rust (*U. appendiculata*), which consists of brown dusty spots, resulting from clusters of spores not enclosed in any pustule, excrescence or peridium. Each of these spores will be found to be furnished with a tiny footstalk, and by means of which they are attached to the living leaf of the bean. The spore itself is unilocular, oboval in shape, terminated by a rounded point, having two distinct coverings, the outer of a deep brown color and smooth, the inner colorless; these enclose a granular matter surrounding a vacant and rounded spot, and having at the top a minute opening. These spores are ripe towards the end of summer, and in harvesting the crop, the brown and snuff-like powder will readily part from the dead foliage, and from the pods, and smut the fingers. Like the seeds of the higher plants they await the return of spring, when, if having fallen upon humid soil, "the spore emits a curved and obtuse tube, which, soon ceasing to elongate itself, gives origin to three or four sporidia, of a kidney shape." If the sporidia should fall upon a living bean-plant, the tube "on being emitted penetrates the wall of any approximate cellule, swells and increases into a cylindrical tube equal in thickness to the original sporidia, and therefore four or five times the diameter of the germ-tube before it entered the cellule. The contents of the sporidia and external portion of the tube pass into the portion within the cellule, and then these external portions perish, and all evidence of the entry is obliterated, except a very minute point at which the tube remains attached to the inner surface of the wall of the cellule. The enclosed tube soon elongates, divides, and becomes branched. These branches pass into the spaces of the pulp of the leaf and become mycelium, a change which takes place in a few hours. Where the sporidia had fallen on the surface of the bean-leaf, little white spots soon appear, and presently little orange protuberances, many of them surmounted by a little drop of mucilaginous fluid. These are *spermogones*, daily increasing in number, and soon after numerous large globular protuberances intermingle with them. These soon rupture the skin of the leaf, and take the orange color and the form of cluster-cups, *Æcidium*. At length the summit of the peridia opens to allow the escape of the stylospores.*

It is easy to assure oneself that the spermogones and the cluster-cups proceed from the same mycelium, and for some time to come the peridia of the *Æcidium* continue to increase, till at length brownish or blackish points make their appearance, intermingled with the cluster-cups, increasing rapidly in number and magnitude. Examined by the microscope they present the ordinary fructification of *Uromyces* mingled with stylospores. Thus the mycelium of the cluster-cups engenders, at the end of its vegetation, fruits equal in all points to those from whence, in the first instance, they are derived. These stylospores found in the cluster-cups possess the irregular globular form and structure of their congeners. If they should be sown on the moistened epidermis (skin or cuticle) of a favorable plant, the sprouting or germ-tube at first creeps along the surface, but as soon as its extremities find a stomate,† it enters it, and elongates itself in the air-cavity‡ below the orifice, receives the contents of the original stylospore and exposed portion of its tube, then separates itself from those parts which become dispersed. The active part increases and ramifies, and produces a mycelium which spreads through the intercellular passages of the parenchyma (pulp). Whitish spots subsequently appear on the surface of the fostering plant, and indicate that the fructification of the parasite is about to commence. The epidermis is elevated and broken, and little brown pustules appear through the openings. These are the stylo-

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**Stylospores*, a second kind of spores borne on long threads, enclosed in a peridium or appropriate pustule.

†*Stomate*, breathing-pore of the leaf. ‡Air-cavity, a space in the pulp of the leaf.

spores of *Uredo*, which are produced in immense quantities, and soon cover the pustules with a deep brown dust. Later, the formation of the stylospores is arrested, and the true germinating spores appear in the same pustules.

The stylospores of *Uredo* are borne singly at the top of short filaments. On arriving at maturity they detach themselves. They are of a globular form, with a reddish brown epispore (covering), provided with little pointed prominences, and three pores at equal distances. After maturity they germinate in precisely the same manner as the stylospores of the cluster-cups. They enter only through the stomata of the epidermis (skin of the leaf). The pulvinules (clusters of powdery spores) are identical with those which the stylospores of *Æcidium* originate, and they also produce true spores at the end of their vegetation. No other fruit arises from them. These organs, therefore, always reproduce the same form to which they owe their origin.

The result of these investigations shows that the Bean Rust (*Uromyces appendiculata*), besides spermogones, possess four sorts of reproductive organs, which all serve to propagate the species, but that one alone of them produces it in a form always identical, while the others present well marked *alternations of generations*. Hence it is concluded that there are, first, *Spores*, which produce the germinating promycelium;* second, *Sporidia*,—these give place to a mycelium, which bears afterwards; third, *Æcidium* ( a condition which exhibits),—particular organs which engender stylospores, and which produce, fourth, the *Uredo*, or a second form of the stylospores and later spores (No. 1), which are always associated with Uredo in the same pustule. The spores and stylospores of *Uredo* come also upon the old mycelium, which had previously produced *Æcidium*. The Uredo stylospores always produce *Uredo* and true spores."

I have thus, with slight alterations, followed the author at some length in the details of this singularly interesting series

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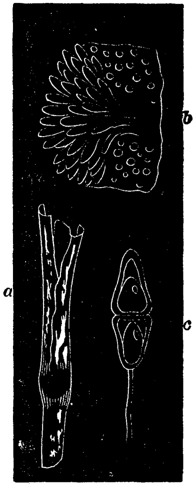
**Promycelium*, the initiatory growth of the mycelium.

of facts, respecting what have been considered as three or more genera of the smaller and parasitical fungi. The account is in effect the epitome of DeBary's experiments, as given in the "Annales des Sciences Naturelles, Series 4, Vol. 20." Starting from *Uromyces*, we successively arrive at *Æcidium* or cluster-cups, and *Uredo* or Rust which, though found in some one of these stages on particular living plants, in reality belong to the development of one and the same parasite. Should any doubt arise as to the validity of these conclusions, the microscope and the too common occurrence of the several kinds or conditions afford facility for question and investigation. A study of similar stages of development by my friend Henry F. King, long ago interested me in the subject, and I here would bear grateful and willing testimony to his patience and skill in microscopical studies pertaining to the structure of the vegetable kingdom, and of its lower orders in particular.

Fig. 2.



The couch grass, or twitch grass (*Triticum repens*), is a well known weed, and though recommended for its nutritive qualities, is seldom cultivated unless in very light and dry soils. But with a pertinacity worthy a better fate, it springs up spontaneously in neglected spots, and can be found almost anywhere. Whoever is familiar with it, must have noticed that its broad leaves and stout stalks are frequently variegated and discolored by linear marks of a dusky hue, which on nearer inspection prove to be veritable cracks of the skin, from which protrude clusters of minute dusty particles. This diseased state is owing to a parasitic fungus, the *Puccinia graminis*, or the Rust, which sometimes does incalculable injury to grain crops. Many other plants are infested with the Puccinia Rust (Fig. 2; *a*, wheat-straw attacked by mildew, *Puccinia graminis; b*, cluster of spores of corn mildew, magnified; *c*, single spore of corn mildew, *Puccinia graminis*, magnified 300 diameters. From Cooke), but as this is so common, let it serve as an example of the whole. If bent on investigating this rust, you will seek it in its first stage, in the form of yellowish elongated pustules, when it constitutes the *Trichobasis rubigovera* of the French botanist Léveillé, and distinguished by one-celled yellow spores, with thickened outer coverings, and supported on short peduncles, which shortly fall away. Later in the season, brown pustules may be observed on the leaves and stems of the same grass plant, and in these, when ripened, the spores are black, club-shaped, slightly constructed, and transversely divided by a septum, the peduncle or footstalk being distinct and permanent. Common as this pretty fungus is, it will repay attention in its microscopical study. In England by a strange confusion, such indeed as exists elsewhere among the unlearned, the first condition of this smaller fungus is termed the Rust, while the second is called *Mildew*. Allowing this latter name as applied to the Puccinia, "there is no doubt that the mildew is very injurious to the corn (grain) crop. Different opinions may exist as to how the plants become inoculated, or how the infection may be prevented or cured.— We are not aware that this question has been satisfactorily determined. It is worthy of remembrance by all persons interested in the growth of corn (grain), that the mildew is most common upon plants growing on the site of an old dunghill, or on very rich soil. As the same *Puccinia* is also to be found on numerous grasses, no prudent farmer will permit these to luxuriate around the borders of his fields, lest they should serve to introduce or increase the pest he so much dreads." (pp. 54, 55.)

I once had brought to me some stems of barley, so much infested with this little parasite, that the entire crop of straw anticipated was most materially injured. In some seasons scarcely any of the firmer and coarser leaved grasses escape its visits. Search for other species of this singularly interesting small parasitic fungus would direct attention to the beauty and variety of the spores; and the leaves of some plants favorable to the growth of certain kinds become so seriously diseased that they appear scorched and burned; to such the old Anglo Saxon word, meaning *to burn*, long ago applied, still adheres in the corn "brands," mint brand, dandelion brand, etc., indicating a still minuter shade of difference where some are "elongated and tapering at each end, some crowned with spicular processes at the top, some echinulate* over the entire surface, and globose, elliptic, nearly parted in two, or others so variable in the same species "that no two are alike,"—any compound microscope of ordinarily good power, with a quarter inch objective, revealing these wonders and delighting the eye. Other beautiful species belonging to other genera of these smaller fungi await indeed the mycological student, and who could not be induced to botanize in such a field of wonders where "complex brands" likewise invite his finding; as in *Triphragmium* with its dark brown, echinulate, three-celled spores; in *Aregma* on the rose leaves with many-celled and cylindrical spores, also echinulate; in *Xenodochnus* with its many-parted, bead-shaped and distinctly articulated black spores; in *Ravenelia* with its acorn-shaped spores—some known to American botanists, others awaiting the fortunate discoverer. And precious as are the carefully dried and hoarded leaves which autumn has painted with matchless colors, how much more valued are they and others, if the receptacles of such microscopical treasures in the Rusts and Brands.

"One of the fungal diseases, long and widely known, has obtained among agriculturists different appellations in different localities. In some it is the *smut*, in others it is, respectively, *dust-brand*, *bunt-ear*, *black-ball*, and *chimney-sweeper*, all referring, more or less, to the blackish, sootlike dust with which the infected and abortive ears are covered. This fungus does not generally excite so much concern amongst

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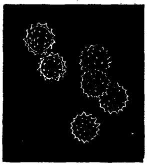
**Echinulate*, covered with small spines.

farmers as the other affections to which their corn crops are liable. Perhaps it is not really so extensively injurious, although it entirely destroys every ear of corn upon which it establishes itself."

Fig. 3.

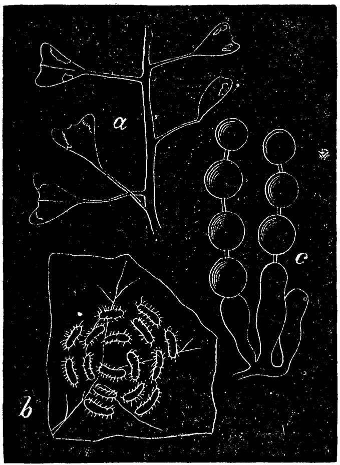


In England and in Europe the "smut" here alluded to, is the *Ustilago segetum*, attacking the heads of wheat and other grain. It is also known in this country, but the one most familiar to us and readily observed on account of the size of the part of the plant it attacks, is the smut of Indian corn or maize, *U. Zeæ* (Fig. 3, spores of *Ustilago maydis*, the maize smut, magnified 400 diameters. From Cooke). The spores in this fungus are exceedingly numerous, "simple, deeply-seated, springing from delicate threads or in closely packed cells, ultimately breaking up into a powdery mass." Like the aforementioned parasites of Coniomycetes, the smut or *Ustilago* has numerous destructive forms which attack various portions of different living plants. Another European species also occurring in the United States according to Dr. Curtis, is the *U. hypodites*, of which we learn from a lecture delivered in the city of Norwich, England, in 1849, and to be found in the Report of the Commissioner of Patents, Executive Document, No. 15, Thirty-first Congress, 1849, that "its spores are black, round, and very small; that there was a great deal of it in 1848, in a field near King's Cliffe, almost every flower stem of the *Bromus sylvatica* being infected by it, and in addition to the ruin of the grass it was most pernicious. According to Léviellé the immense quantity of black dust resulting from it in the hay-fields in France, produces disastrous consequences on the haymakers, such as violent pains and swellings in the head and face, with great irritation over the entire system."

Like the "brands," the "smuts," too, have kinds with complex spores, of which one called *Polycystis*, or many-cysted smut, attacks the stems of violets, the leaves of buttercups, and similar plants. Although noticed abroad, as we learn from our author, the name does not occur in Dr. Curtis' list, nor the *Tubercinia*, whose bullate and blistered peridia attacks the European Trientalis, or star-flower, and may therefore reasonably be sought for by us in our northern New England co-species. The only approach to these complex smuts is in the *Thecaphora*, which differs from the maize smut, in its spores being made up of three or many irregularly hexagonal parts, each echinate and beautiful microscopic objects, which I think I once received from my friend Charles J. Sprague, Esq., who is so celebrated for his mycological knowledge of the fungi of Massachusetts.

The usual idea we have of rust and rustiness is something similar to the rust of iron, and a rusty color is one of a yellowish brown hue. But the word is used in a wider sense when employed to denote a parasitic fungal, and we accordingly are informed of "White Rust" in another of the smaller fungi, which, from its too intimate connection with agricultural crops, is worth some attention. Thus the white rust of the cabbage, turnip, and similar plants, is owing to the presence of the *Cystopus candidus* (Fig. 4; *a*, fruit of shepherd's-purse with white rust, *C. candidus; b*, portion of cabbage leaf with the same species; *c*, conidia of the same species. From Cooke), which appears in circular patches of white spots, and causes the leaves to become deformed, swollen and blistered, even before we can trace the cause of the mischief on the outside. These blistered pustules have a minute system of branching threads, which traverse the pulpy parts of the leaves, and which threads,

Fig. 4.



insinuating themselves between the cells that constitute the pulp, derive their nutriment at the expense of the growing foliage. It is after the pustules assume the white color, and are visible on the skin or cuticle, that the reproductive parts termed *conidia*, can be detected. Indeed the whole interior of the white pustules is made up of bundles of club-shaped tubes, which have been extended from the system of threads, and which tubes give off bead-like strings of cells, each bead by turns parting from the chain or necklace, and escaping into the air through the distended and ruptured pustule. From the multitude of these beads or spores, forming a white powdery dust, the term "conidia" is applied, which means dust-like. Other plants beside are similarly affected, and the water-cress, pepper-grass, mustard, radish, shepherd's-purse, and even the purslane, fall victims to its ravages. That so hardy a weed as the shepherd's-purse (*Capsella bursa pastoris*) should become pallid and sick, indicates the nature of the drain which is made on its juices by this parasite, and it is not improbable that the "clubbing" of the cabbage, where the stalk becomes gouty and swollen, and refuses to make a healthy growth, may be owing to similar exciting causes in the presence of the mycelium of some fungus in its tissues. From the researches of M. Provost, in 1807, we learn that the germination of the conidia, or spores, is one of the most curious phenomena of plant life, and indicates in this low order of vegetation, a relation to higher structural forms, not only in plants but even in animals. Thus, if a few particles of the white dust is thoroughly immersed in a drop of water, and examined under the microscope, "they will rapidly absorb the water and swell; soon afterwards a large and obtuse papilla, resembling the neck of a bottle, is produced at one end of the extremities. At first vacuoles* are formed in the contents of each conidium (spore). As these disappear, the whole granular substance filling the conidium becomes separated by very fine lines of demarcation, into five to eight polyhedric portions, each with a faintly colored vacuole in the centre. These portions are so many *zoöspores.* These are soon expelled one by one, afterwards begin to move, the zoöspores themselves provided with vibratile ciliæ swim away, each a seeming animalcule, but in reality only a sort of bud endowed with motion, and such as exist in some other plants. The particular office of the zoöspore, whether issuing from a conidium, or from some other process in the growth of the parasitical fungus, is to serve as a medium to the impregnation of the plant, be it weed or valuable farm vegetable; and curious to say it has been proved that the entrance into the pulp tissue of the same vegetable, is neither through the roots nor by absorption of the leaves, but invariably through the seed-leaves, first leaves or *cotyledons*, as they are scientifically termed. The prodigal provision of Nature is here, as everywhere, especially in its lower organizations signally manifested, when we are told that "the immense number of zoöspores capable of being produced from a single infested plant is almost beyond calculation. It is easy for a million of conidia to be developed from such a plant, each producing from five to eight zoöspores, besides a large number of other organs each containing a hundred zoöspores. It can scarcely be considered marvellous that the white rust should be so common on plants favorable to its development, the marvel being rather than that any plant should escape." (p. 136.)

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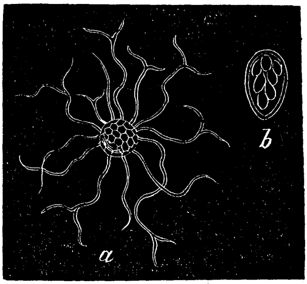
* *Vacuole*, a little vacuum, or seeming empty space.

Quite a distinct family of the smaller fungi, and far more injurious in many instances, is termed *Hyphomycetes*, *i. e.*, fungi whose growth consists in throwing out delicate threads. In this family there are several distinct but natural groups, and with one of these groups called the *Mucedines*, we have something to do. The little fungi here specified are the true *Moulds*, and very naughty effects they produce, as we shall learn on a better acquaintance than the usually superficial one, which is confined to mouldy bread and cheese and other viands, and which are so bright and vivid in color that they at once attract the attention, the most alarming and insidious requiring the higher powers of the microscope, and under their almost invisibility working signal destruction. Like the coniomycetes, or dust-fungi, which we have noticed, the hyphomycetes or thread-fungi, and the mucedines or true moulds, which are included, are provided with a vegetative system of branching threads, called the mycelium, but unlike the former, these have fertile or spore-bearing threads which are perfectly distinct. These latter kinds are "sometimes simple and sometimes branched; they may be articulated or without articulations; short or long, erect or creeping; transparent or whitish, mostly free from color, and are not coated with a distinct membrane. The spores are generally simple, sometimes solitary, at others in pairs or strung together like beads for a necklace. Amongst all this variety of arrangement there is order, for these are but features, or partly the features of the different genera of which the *Mucedines* are composed. One of the genera is termed *Peronospora,* known by its having for the most part inarticulate or jointless threads and two kinds of spores, one kind on the tips of the branches, the other, larger and globose, on the creeping mycelium or spawn. The diseases of many of the most valuable farm crops, are in Europe and England attributed to the several species of the Peronospora, and are called the dock, lettuce, onion, parsnip, potato, rose, spinach, and tare or vetch moulds; each so specifically distinct as to be recognized on whatever plant may foster it, and destructive and dangerous. Whether the same kinds, or indeed whether the peronospora injuriously affects the same vegetables in this country, observation and research at present only can decide. Its effects in the potato disease are considered in a paper in a previous issue of the NATURALIST. I only know that I have met with a similar mould on decaying Agarics, strongly resembling Caspary's figures, and to which allusion has before been made. In like manner the "white mildews or blights" are due to sundry other hyphomycetes or thread-like smaller fungi, which, equally abroad and in this country seriously affect the leaves and fruits, and seed-vessels of various living plants. Of these mention has been made of the *Erysiphe* when noticing the dimorphism of certain fungi, and the list of plants to which the several species of this injurious little fungal growth and of its allies attaches itself, would be perhaps about the same at home or abroad. Any one who has had to do with the greenhouse kept at a low temperature, with the plant propagating house, or with the culture of the parlor plants, must be familiar with the rose-leaf mildew, especially when it so suddenly attacks the finer and tender sorts of the tea roses; and will recognize in the following description this insidious pest: "The first species in our enumeration is found on cultivated roses. What a deplorable picture does a favorite rose-bush present when attacked by this mildew! The leaves blistered, puckered and contorted; their petioles and the peduncles and calyces of the flowers swollen, distorted, and gray with mould, and the whole plant looking so diseased and leprous that it needs no mycologist to tell that the rose is mildewed. This species is the *Sphœrotheca pannosa* of Léveillé." (pp. 165, 166.) The hop mildew abroad is an allied species, the hazel, oak and beech mildew attacks the alder leaves here in *Phyllactinia guttata;* the English willow blight is here found "common on living leaves" (Curtis); the foreign barberry mildew, *Microsphœria*, is here under several species; the common white mildew, *Erisyphe communis* (Fig. 5; *a*, conceptacle of buttercup blight × 80, *E. communis; b*, sporangium of the same, highly magnified. From Cooke), is so "common" that it well deserves the name; the singular bristle mould, *Chœtomium chartarum*, attacks wet paper here as well as

Fig. 5.



abroad. Another bristle mould is found on rotting grass; the *Eurotium herbariorum*, pesters our botanists by its presence in their collections of dried plants, and so wide is the geographical range of many kinds of smaller fungi, that no country and scarcely any latitude escapes their visitations.

The exquisite elegance of the spores of the fungi should suggest the dry and wet mounting of them in glass slides for the microscope. Entire plants and portions of others could be readily prepared, and the patience, enthusiasm, and skill of a Bicknell are all that are requisite for a beginning in this direction.

It is with extreme reluctance that we lay down this fascinating little treatise; its pages indeed may be read and re-read with constant profit. To this and to similar works, the botanist, the general enquirer, and the agriculturist are equally indebted, and well will it be for this country when the American press shall issue many and such as this.

# A CHAPTER ON FLIES.

### BY A. S. PACKARD, JR.

[Concluded from page 596.]

THE common House-fly, *Musca domestica* Linn., scarcely needs an introduction to any one of our readers, and its countenance is so well known to all that we need not present a portrait here. But a study of the proboscis of the fly reveals a wonderful adaptability of the mouth-parts of this insect to their uses. We have already noticed the most perfect condition of these parts as seen in the horse-fly. In the proboscis of the house-fly the hard parts are obsolete, and instead we have a fleshy tongue-like organ (Fig. 1), bent up underneath the head when at rest. The maxillæ are minute, and their palpi (*mp*) are single-jointed, and the mandibles